Securing Sahelian pastoral activities through the use of remunerated labor: ambivalence of monetization

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Abstract

Sahelian pastoralists are usually portrayed as people living under uncertainty: they lack contingent markets and use mobility and diversification/multiple activity as adaptation strategies. Their complex relationships vis-à-vis this uncertain environment hide the transition from a traditional inward looking to an outward looking economy characterized by increasing recourse to remunerated labor. However, this growing monetization of their economy is not neutral and could generate new forms of uncertainty. A Principle-agent model helps to analyze the remunerated labor as an ambivalent strategy to structural uncertainties in the Senegalese Sahel. Then, the paper highlights the conditions of production of trust and reputation in employee-employer relationships developed by pastoralists to better face up to these uncertainties.

Keywords: pastoralism, Sahel, uncertainty, wage-labor, monetization

Introduction

Sahelian pastoralists are leading lives full of uncertainties. They lack contingent markets for their produce; this is severely affecting their livelihoods. They are gradually adapting to these conditions by using mobility and diversification/multiple activity strategies to enhance production and ultimately their livelihoods (Wane et al. 2015; Ancey et al. 2010). These strategies are characterized by complex relationships, which hide multi-level strategies such as the use of remunerated workers and renewing the delegation of tasks usually handled at the family level.

Although it is a relatively old practice, the use of remunerated employees is still poorly documented (Wane et al. 2009 2010). This practice is meant to complement cattle herding and mobility but has increasingly become a wage-labor relationship. The practice seems to be a form of case management strategy, which targets a class of Sahelian structural uncertainties linked to the asymmetric distribution of pastoral resources. The use of remunerated employees helps tackle both internal (labor availability, intra-family diversification) and external uncertainties (species diversification, natural resource scarcity) and contributes to the on-going herd management (Wane et al. 2009, 2010). It also reflects an increased commodification and monetization of social relations and practices in pastoral areas.

In a context of accurate information between the contracting parties (livestock keeper as employer and shepherd as employee), commodification should be neutral in terms of emerging uncertainties, as the payment of a fixed salary seems to be the best option for both the shepherd and the livestock keeper.

In reality, the context is rather marked by information asymmetry and with stakeholders' actions; this could be a source of moral hazard and adverse selection. In such cases, in-depth investigations should be conducted to determine how Sahelian pastoral settlements manage the remunerated employees in a context of inaccurate information and especially increased commodification of economic transactions.

This paper used an economic database of 149 georeferenced pastoral encampments investigated in 2006-2007 to tabulate wage-labor indicators from a conceptual framework incorporating the characteristics of Sahelian pastoralism.

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We used a Principle-agent model, contract and signal economic theories to analyze the wage-labor as an ambivalent strategy to structural uncertainties in the Senegalese Sahel. Thus, we specifically examine concepts of adverse selection and moral hazard in this context and the conditions of production of trust and reputation in employee-employer relationships.

1. Principle-Agent model as an analytical framework for the analysis of employment relations in Sahelian pastoral areas

Many studies in livestock farms are exploring ways to represent, qualify and model working practices in the globalization context (Dedieu and Servière 1999; Madelrieux et al. 2006, 2015). Other analyses focused on wage-labor on farms: they examine the supply of employee labor (Lass and Gempesaw 1992; Ḳimḥi 2001) and particularly on the trade-offs between internal and external work (Reardon et al. 1992; Lass and Gempesaw 1992; Woldehanna 2000; Corsi and Findeis 2000; Mishra and Sandretto 2002). Yet, there are very few surveys on the demand side of labor (White et al. 2008) and those that exist have analyzed labor in capital-intensive farms only (Vanderman et al. 1991).

At the same time, Sahelian pastoral households still pursue a composite utility function that balances their short-term consumption needs and long term herd building strategy to meet future consumption. These behaviors are not systematically monetary-oriented and often coincide with the expectations of the head of household (Gasson et al. 1988; Wane et al. 2009a, 2010). The analysis of pastoral household decisions is still being linked to the theoretical corpus of household producer-consumer conceptualized by Chayanov (1923).

The occurrence of wage-labor is common in Sahelian pastoral areas but little has been documented about the wage-labor phenomenon. It could be best addressed by the Principle-Agent approach to explain the interrelationships between employers (farmers) and employees (shepherds). In the Principle-Agent relationship, an economically dependent entity called Agent manages assets of another economically strong entity called Principle. The Principle must provide compensation without having any accurate information about the agent's efforts (Mirrlees and Raimondo 2013).

This model is based on the seminal work of Holmström and Milgrom (1979, 1987) and many works have documented its application on social-economic transactions. Although the use of game theory tools in the Principle-Agent modeling has led to mathematical development and sophistication[5], our approach is similar to those of Debraj (2012). So, let us consider Q the production level expected by both parties and e the level of effort required. For the Principle, it is possible to have a low output Q^f when the Agent provides low level of effort ($e = 0$) and *vice versa* a high output Q^e for a high level of effort ($e = 1$).

$$\boxed{\begin{cases} Q = Q^f & if\ e = 0 \\ Q = Q^e & if\ e = 1 \end{cases}} \qquad (1)$$

The level of production Q depends on the Agent's level of effort and will be high p_e when the Agent provides great effort or low $p_f = 1 - p_e$ when the level of effort is low or null: with $\boxed{0 < p_f < p_e < 1}$ in addition, providing effort is not financially neutral for the Agent. There is a cost $C = \begin{cases} C^f \\ C^e \end{cases}$, according to both the level of effort and the incentives[6] expressed by the Principle. The Agent utility depends on the wage level and the efforts made. Two conditions could influence this utility:

- a situation of fixed salary : $\begin{cases} u(w) - C^e \\ u(w) - C^f \end{cases}$

[5] Mirrlees and Raimondo (2013) provide strong knowledge on mathematical contents of Principle-Agent model.

[6] The term "incentives" can cover a narrow meaning from a monetary payment against a measurable outcome to a reward (not only monetary terms) against a measurable effort.

- a situation of variable salary according to the efforts made by the Agent: $\begin{cases} u(w_e) - C^e \\ u(w_f) - C^f \end{cases}$

At this stage, how to develop a contract with an optimum salary level to ensure the highest level of efforts provided by the Agent?

The Principle who aims at effective control of scarce resources and production activities will offer incentives to influence the behavior of the Agent. However, before hiring, the Principle must manage two constraints: (1) a participation constraint (or individual rationality as notified by Varian 2014): the Agent must work before payment. This constraint ensures the agent's reservation utility (equivalent to what could give him another opportunity) and if there is another contractual option enabling the Agent to obtain a utility $u(a)$ thus, the Principle must label the contract as shown below:

$$\boxed{\begin{cases} p_e u(w_e) + (1 - p_e)u(w_f) - C_e \geq u(a) \\ u(w) - C_e \geq u(a) \end{cases}} \qquad (2)$$

(2) An incentive compatibility constraint (or self-selection as stipulated by Varian 2014; Laffont and Martimort 2002; Bolton and Dewatripont 2004) which says that the Agent must receive a higher utility from exerting effort than for not.

$$\boxed{\begin{cases} p_e u(w_e) + (1 - p_e)u(w_f) - C_e \geq \square_f u(w_e) + (1 - p_f)u(w_f) - C_f \\ u(w) - C_e \geq u(w) - C_f \end{cases}}$$

$$==> \boxed{\begin{cases} [u(w_e) - u(w_f)](p_e - p_f) \geq C_e - C_f \\ C_e \geq C_f \end{cases}} \qquad (3)$$

It is assumed that the Agent is risk-averse. Therefore, in a context of uncertainty and random income, the Agent expected utility is lower than it would have been if he received a guaranteed expected income. The Principle is risk-neutral and his/her goal is to design a contract or agreement maximizing his/her expected return (monetary or not). The Principle will also manage two types of problems: (1) a hidden information problem such as the Principle when hiring is unable to get information on whether the employee is multi-skilled or not. (2), a hidden action problem or moral hazard, for instance, one parties' transaction depends on the other parties' action. This case is recurrent in fixed-salary contracts since the level of effort required is not perfectly observable in advance by the employer. The Principle can develop the contract by assessing the following two possibilities:

- A situation in which the efforts made by the Agent are observable (first-best contract) either directly by the Principle or indirectly by a third party. The Principle pays for the services of the third party. The Principle designs contract payment as well as adjusting agent's salary when satisfied by his/her efforts. Thus, the optimal contract is to provide a guaranteed payment$\overline{w}$ covering participation and incentive compatibility constraints of the Agent.
- A situation where the efforts made by the Agent are not observable (second-best contract), the Principle considers a payment based on the agent's effort. But his/her dilemma is to find a value between high payment $\overline{w}_e$ if the deliverable is satisfactory and less payment $\overline{w}_f$ to optimize the expected results while respecting participation and incentive compatibility constraints of the Agent.

In Principle-Agent transactions, the gains expected by the Principle depend on the Agent's actions and efforts to produce and achieve the expected results. The Agent's effort is core in Principle-Agent transactions and many theoretical contributions[7] have analyzed which incentives motivate the agent to provide adequate efforts for a given production level. Though agent's efforts are positively correlated to the final outputs, the occurrence of random exogenous shocks affects the agent's efforts to achieve

[7] See Holmström et Milgrom (1991), Prendergast (1999) for an overview of the literature on the theory of contracts in the seventies and nineties.

the expected results (Rubin and Sheremeta 2015). These studies have also examined the best way to design an optimal contract in an inaccurate information situation, but only a few of them selected the portion of income related to the presence of hazards and those resulting from the Agent's efforts (Charness and Kuhn 2011; Rubin and Sheremeta 2015).

Moreover, economic agents are considered selfish and pursue personal interests. As a result, the contracting parties reciprocate this type of behavior (Fehr and Gächter 2000). Empirical studies have incorporated this form of positive and negative reciprocity by using game theory (Charness and Haruvy 2002; Fehr et al. 2007; Falk and Fischbacher 2006). Other empirical surveys show that 40 to 60% of individuals in contractual transactions would reciprocate choice while 20 - 30% would behave purely selfishly (Gächter and Falk 1999; Fehr and Falk 1999; Abbink et al. 2000).

2. Reality and determinants of use of salaried workforce in the Ferlo

The Ferlo is the main pastoral farming area in Senegal covering a vast area of 67,610 km². It experiences erratic rainfall of yearly averages below 200 mm in the north and above 550 mm in the south. Pastoral farming is the principle mode of economic valuation of these arid areas and livestock keepers are operating in a context of uncertainty. Mobility is gradually being recognized as an adaptation to environmental conditions, securing the livestock too, and encouraging the increased use of hired labor (Marshall and Hildebrand, 2002). Pastoral households in the Ferlo attach high value to animal production management. They commit 98% of their time to herd management (through watering, milking and transhumance), while the rest of the time is spent on other ad hoc tasks (salt cure) (Wane et al. 2009b). Our assumption is that securing animal production by encouraging the use of salaried labor should be a priority for pastoral households in Ferlo therefore we present our findings on the realities and determinants of the use of salaried labor in Ferlo.

Our analysis is of primary data collected between June 2006 and June 2007 on a sample of 149 pastoral settlements[8] on five representative pastoral and agropastoral sites (Boulal, Keur Momar Sarr, Niassanté, Tatki et Thieul). It shows that 25% of pastoral settlements declare that they use a salaried workforce. This finding contributes to the revision of the idea of Sahelian pastoralism as an economic activity based solely on family labor. In these pastoral farms, production and sales decisions are often disconnected from market imperatives (Wane et al 2009b, c). The use of salaried labor in these farms stems from multiple trade-offs between the organization of internal work, family activities and income gains from livestock.

Table 1 – Determinants of pastoral wage labor in the Ferlo (Wane et al, 2010)

	Variables	B	E.S.	Exp(B)	Odds ratios [Exp(B)-1]*100	Nagelkerke's pseudo R-squared
« Gender » Model	Household***	-0,476	0,171	0,621	-37,9%	42,0%
	Woman**	0,123	0,061	1,131	13,1%	
	Labor transfer***	-2,975	1,146	0,051	-94,9%	
	Cattle**	0,012	0,006	1,012	1,2%	
	Sheep***	0,009	0,003	1,009	0,9%	
	Constant	3,042	2,228	20,956	-	
« Age group» Model	Household***	-0,494	0,182	0,610	-39,0%	42,4%
	Third Age*	0,309	0,168	1,362	36,2%	
	Cattle**	0,014	0,006	1,014	1,4%	
	Sheep***	0,008	0,003	1,008	0,8%	
	Labor transfer ***	-3,213	1,177	0,040	-96,0%	
	Constant	3,719	2,274	41,222	-	

- *Notes:*
- **** significant at 1%, ** significant at 5%, * significant at 10%*
- *The* Nagelkerke's pseudo R-squared*, adjusted version of Cox & Snell's pseudo R-squared, is more relevant in our case*
- *Non-significant variables are not shown in this table.*

Furthermore, we applied a logistic regression to these primary data and findings revealed that the number of households in the pastoral encampment negatively determines the use of salaried labor

[8] A pastoral encampment is a large unit of residence grouping one or more households.

(very significant contribution at 1% level) and the labor transfer rate (Thor)[9] (very significant contribution at 5%). The decision to use salaried labor is positively influenced by the many sheep in the herd and managing all of them is time-consuming (very significant contribution at 1%), the number of women living in the encampment (very significant contribution at 5%) and to a lesser extent by the number of people aged over 50 years living in the encampment (very significant contribution at 10%) (Wane et al 2010) (**Table 1**).

During the dry season in the arid Ferlo, pastoral households hire seasonal or permanent labor for transhumance. The number of employees hired depends on the herd size; large livestock producers employ many employees (69%) and also have a lower labor transfer rate (9%) because they have enough financial resources to own large herds and hire many employees. Conversely, small livestock producers have inadequate financial resources to own large herds and employ and retain employees. There is high labor loss in this category (labor transfer rate of 33%). In the intermediate categories of "large livestock keepers " and "medium livestock keepers", the situation is less well defined. There is need for livestock producers to seize opportunities in the region and earn a decent income from the production of animals (Wane et al 2010).

Data collected through interviews on a subset of 149 encampments show that 87% of respondents identified (1) technical factors (of herd composition in terms of species and herd management) and (2) individual aspirations as factors motivating them to use salaried labor (Wane et al 2009a).

Other factors that determine use of salaried labor include land pressure; 54% of employers cite the use of wage labor as a means to prevent neighborhood conflicts. In southern Ferlo, in agro-pastoral sites such as Boulal, Tatki and Thiel, land conflicts between farmers and herders have significantly reduced because farmers employ herders that keep animals far from crop areas.

Despite structural uncertainties, wage labor is an opportunistic strategy. Nearly 81% of employers declare that use of salaried labor frees up time for other income generation activities. Economic diversification is mainly in the form of trading particularly in the site of Boulal that is very close to the bigger livestock market (Dahra) and in the site of Thiel closer to the Groundnut Basin.

However, the use of salaried labor is itself a source of uncertainty that producers are trying to reduce. In the informal context of Ferlo, this strategy contributes to the increased commodification of social transactions that is also a source of new uncertainties.

3. Ambivalence about monetizing employment relationships and conditions of trust in the Sahel

In the Sahelian context, a breeder (the Principle) recruits a shepherd (the Agent) for herd management during the lean season and sometimes in the rainy season to control animals from grazing in crop areas. This recruitment results in a predetermined wage paid periodically. Contractual commitments between breeders and shepherds are usually developed on the basis of gentleman's agreement in the presence of witnesses from the contracting parties.

3.1. Participation and incentive compatibility constraints

The participation constraint of the shepherd seems to be very low or even zero in Ferlo because there are enough personnel, and shepherds have a strong desire to increase their own herd by buying animals using wages.

In Incentive compatibility constraint, shepherd recruitment was built around a service in return for an in-kind contribution (predetermined number of small ruminants to exchange and/or days in milk, coverage of food and clothing expenditures) to encourage shepherds to manage animals effectively in a challenging environment characterized by scarce resources. For example, breeders would like adequate milk from animals; the breeders offer an incentive to motivate shepherds to seek quality and

[9]The labor transfer rate is the ratio between the number of encampment members declaring remunerated external activities and the total population of the encampment. (Wane et al 2010)

enough pastures. Thus, in terms of incentives, the shepherd could be more motivated on improving the quantity of milk. However monetization in the form of a fixed salary complicates this constraint, as other incentives are required to avoid the Agent modulation efforts.

3.2. Management of non-observable efforts

The establishment of a specific agreement on the payment of a fixed salary[10] in pastoral areas is likely to lead to further uncertainty and stabilization modes of trust over traditional forms of work. According to Salais (1989, 2001), wage referral may cause a rift in the production organization, resulting in a form of radical uncertainty on productivity. After recruitment, production uncertainties can emanate from quality and employee behavior. However, this approach is based on commodity production and is only partially applicable to the Ferlo where production is not fully developed, immediate or only intended for the market (Wane et al 2009b). Farmers oppose this form of radical uncertainty on productivity because of other socio-economic guarantees and not the contract.

Breeders in the Ferlo manage shepherds' efforts through a form of assessment they developed based on endogenous knowledge. They make daily observations of the herd before and after grazing to monitor weight loss, milk production and animal behavior (restless, quiet), and also control daily employee behavior (rigor at work and social relationships). In addition breeders also used to visit the shepherd during transhumance to monitor and evaluate shepherds' efforts and behavior. Visiting the shepherd during transhumance is an informal form of monitoring and evaluation. Also, breeders manage uncertainty on the equivalence between "future work" and "wages" by building trust with shepherds and monitoring their efforts regularly.

Conditions of trust

By tracking the conditions of trust, Reynaud (1998) emphasizes a radical cleavage between the approaches of confidence in terms of cumulative capital and those of trust (inseparable from social and collective reality going beyond the strict framework of rational calculations). This cleavage is not compelling in the context of the Ferlo where use of salaried labor is seen as a strategy to secure and not maximize the production.

The following are the conditions for trust:

Recruitment
Recruitment is primarily based on the reputation of the employee. Trust, often put forward by employers, is not spontaneously acquired. It is generated by individual interests to ensure and maintain a reputation (Kreps 1990) and behaviors are influenced by collective beliefs and socio-cultural practices (Granovetter 1985). Recruitments are made on the basis of locality and ethnicity as discussed below.

- ✓ **Geographical proximity and ethnicity**.

Employers enjoy high levels of trust and confidence with employees with whom they share a locality and an ethnic group. On average 78% of employers hire Fulani employees and 41% of them hire from their own ethnic group. Boulal, the region near the capital city of Dahra, revealed a higher percentage of these cases (83% of employees share a locality and ethnic group with their employers and 67% of employees are from the same ethnic group as their employers). Employers rely on these signals in order to better manage recruitment-related hazards.

Employer-employee relationship

The relationship between employers and employees helps establish and nurture trust. The employee is generally regarded, as a family member of the employer who enjoys basic needs (food, shelter and

[10]The average monthly wage is 17,389 XOF francs (minimum 8000 XOF and maximum 24 000 XOF). The remuneration is on a monthly basis for over 72% of respondent's employees. For 28% of them, it is done on an annual basis and often in-kind for others, with a predetermined number of animals agreed with the employer at the beginning of the contract (Wane *et al,* 2009a).

clothing). This combination of monetary and non-monetary remuneration depends on the employee status. The category of " *gaynako* " has more stable and sustainable employment contracts than " *sourga* " and " *saardi* ". The latter two types of employees remain highly uncertain and highly correlated to intrinsic functioning rhythms of farming operations.

Sahelian pastoralists are aware of the exogenous shocks and the diverse nature of shepherds' uncertainties, thus breeders protect herds against these shocks as well as shepherds' behavior.

Conclusion

The exploratory study of the use of salaried labor changes the usual representation of the pastoral family farm. At the time of the survey, the use of salaried labor involved 25% of Ferlo encampments in the form of informal contracts, based on the strengthening knowledge networks. Thus, pastoral livestock is not exclusively secured by family resources, but rather by combining receptive modes of production and economic opportunities. Breeders seek to reduce the uncertainty induced by the delegation of tasks by seeking confidence factors (recruitment in the ethnic sphere even geographical and fractional), monitoring the level of effort of the employee (accompaniment by a family member) and controlling results (daily observations based on a proven system of traditional knowledge). From a theoretical point of view, the findings in the economics of pastoralism illustrate some traits coming from heterodox models and are not intended to validate the theory in the field, but as an exploration of the general considerations. Moreover, the use of salaried labor in Sahelian pastoral areas (both multifaceted social relations and economic activity) will provide references on the evolution of the issue of agricultural work and family farms.

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